Biological Data on Arctic Charr, *Salvelinus alpinus* (L.), from the Coppermine River, Northwest Territories, 1981-82

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Le titre exact paraît au haut du résumé de chaque rapport.

Canadian Data Report of
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ABSTRACT

Gillman, D.V., and A.H. Kristofferson. 1984. Biological data on Arctic charr, Salvelinus alpinus (L.), from the Coppermine River, Northwest Territories, 1981-82. Can. Data Rep. Fish. Aquat. Sci. 440: iv + 16 p.

Biological data (age, length, weight, sex, maturity, condition) for Arctic charr collected from domestic and experimental gillnet fisheries in the Coppermine River in 1981-82 are presented in this report. Charr taken by the domestic fishery in August 1981 had a mean length of 654 mm, mean round weight of 3 868 g and a mean age of 9.5 years. Charr captured by the domestic fishery during October and November, 1981 had a mean length of 509 mm, mean round weight of 2 004 g and a mean age of 7.1 years. The 1981 experimental gillnets took charr with a mean length of 418 mm, mean round weight of 1 036 g and a mean age of 5.6 years. Charr taken by the domestic fishery in 1982 had a mean length of 583 mm, mean round weight of 2 661 g and a mean age of 8.5 years. Although the harvest level of the domestic fishery has declined considerably compared with previous years, this fishery remains very important to the community of Coppermine, Northwest Territories.

Key words: age composition; catch/effort; experimental fishing; mesh selectivity; sex ratio; sexual maturity; size distribution.

RESUME

Gillman, D.V., and A.H. Kristofferson. 1984. Biological data on Arctic charr, Salvelinus alpinus (L.), from the Coppermine River, Northwest Territories, 1981-82. Can. Data Rep. Fish. Aquat. Sci. 440: iv + 16 p.

Ce rapport renferme des données biologiques sur l'omble chevalier (âge, longueur, poids, sexe, maturité, état) provenant d'une étude des pêches familiales et expérimentales aux filets maillants effectuées dans la rivière Coppermine en 1981 et 1982. En août 1981, l'omble moyen récolté par les pêcheries familiales mesurait 654 mm de long, avait un poids brut de 3 868 g et était âgé de 9,5 ans. En octobre et novembre 1981, l'omble moyen récolté par ces mêmes pêcheries mesurait 509 mm de long, avait un poids brut de 2 004 g et était âgé de 7,1 ans. En 1981, l'omble moyen provenant des pêches aux filets maillants expérimentales mesurait 418 mm de long, avait un poids brut de 1 036 g et était âgé de 5,6 ans. En 1982, l'omble moyen des pêcheries familiales mesurait 583 mm de long, avait un poids brut de 2 661 g et était âgé de 8,5 ans. Même si les prises des pêcheries familiales ont beaucoup diminué par rapport à celles des années précédentes, cette industrie occupe toujours une place importante aux yeux de la collectivité de Coppermine aux Territoires du Nord-Ouest.

Mots clefs: moyenne d'âge; rapport prise-effort; pêche expérimentale; sélectivité des mailles; rapport de masculinité; maturité sexuelle; répartition par taille.

INTRODUCTION

Traditionally, the fishery for anadromous Arctic charr, Salvelinus alpinus (L.), at the Coppermine River near Coppermine, Northwest Territories, has been for domestic use. Recently, success by other communities involved in commercial charr fisheries has prompted increased interest in commercial fishing at the Coppermine River. Presently an annual commercial quota of 600 kg is allowed and the product is sold locally. Requests have been received to increase this quota. In order to protect the domestic fishery the status of the stock must be evaluated to determine whether it can withstand an increase in commercial fishing. Also, the present extent of the domestic fishery must be revealed to determine whether its value to the community is increasing or decreasing. This study conducted in August 1981 represents the preliminary steps to achieve these objectives.

MATERIALS AND METHODS

STUDY AREA

The Coppermine River empties into the Arctic Ocean at 67°-50'N, 115°-05'W, approximately 670 kilometers north of Yellowknife, Northwest Territories (Fig. 1). Topography is typical of western Arctic coastal areas consisting of rolling hills and rocky cliffs (50-100 m in height) interspersed with wide valleys and tundra flats. Vegetation is low and sparse and restricted to the lower reaches of creeks and rivers.

The Coppermine River is an extensive system originating in the Point Lake-Lac de Gras area about 375 km south of Coppermine. Study activities were confined to that portion of the river from the mouth upstream for 16 km to Bloody Falls, since this was the area most frequently fished by the residents of Coppermine (Fig. 2). Bloody Falls is a series of low rapids and shelves (1-3 m) impassable to boat traffic. The river below the falls varies in width (30-100 m) and in depth (1-7 m). Current is rapid and strong immediately below the falls and diminishes where the river forms a delta at its outlet. A central channel runs the length of this portion of the river; however, navigation remains difficult as sand and gravel bars and large boulders are scattered randomly along the river course. The delta area is comprised of three major channels, the west having the greatest width, depth, and velocity. The community is situated to the west of this channel on the edge of the sea coast (Fig. 2).

THE FISHERY

A review of past fishing is difficult as accurate statistics are not available. However, Abrahamson (1964) provides some data on population density, fishing methods, and fish utilization. He states that during 1963 a total of 77 families were enumerated comprising 357 individuals possessing 522 dogs. Annual fish consumption per family (including dogs) was estimated at 907 kg of Arctic charr and 227 kg of lake whitefish, Coregonus clupeaformis (Mitchill). Apparently the harvest was insufficient to meet the requirement of the community as the majority of families expended their supply of fish by January. Therefore, a minimum of 70 000 kg of Arctic charr was required to meet subsistence needs alone, consequently fishing was heavy. During the summer of 1963, one hundred and seventy-four 10 m gillnets were counted in the Coppermine River and most were of 89 mm mesh size (Abrahamson 1964). Local residents interviewed during 1963 by the above author felt that the charr fishing in the Coppermine River was declining in both numbers taken and the size available when compared with past catches.

Information from a rabies vaccination program (R. Pedersen, personal communication) and Government of the Northwest Territories (GNWT) Wildlife Service records indicate that the dog population rose to near 1 000 during the mid-1960's as local interest in dog team racing increased. A long-time resident and team owner during this period estimated the winter consumption of fish at 90 to 100 kg of charr per dog (Colin Adjun, personal communication). Hence at least 90 000 kg of fish were needed annually to meet this requirement in addition to the fish utilized for human consumption. Although this figure cannot be verified it is reasonable to conclude that the Coppermine River has supported heavy domestic fishing in the past. Local residents interviewed during 1981 indicated that the fishery was in its worst state during the mid- to late-1970's as the average size of charr taken was 0.9 to 1.4 kg. Most gillnets used at that time were 63 to 89 mm mesh size.

Significant changes in the fishery have since taken place. Snowmobiles have replaced working sled dogs (Colin Adjun, personal communication). Present estimates (R.C.M.P., Coppermine) place the resident dog population at 150 of which half or more are household pets. Fish continues to provide dog food; however, it is estimated that the present fish requirements for dog food have been reduced by 80 percent of past levels. The human population increased from 377 in 1963 to 727 in 1974, and to 766 in 1979 (N.W.T. Community Data 1974, 1981) and is currently estimated at 950. Charr continues to constitute an important part of the local diet although improved transportation systems and the resultant increased availability of southern food goods has lessened the dependence on charr as a principal food source. Estimates of the annual consumption of Arctic charr for domestic use were provided by GNWT Wildlife Service, Coppermine (Colin Adjun, personal communication). Based on annual community surveys during 1981 and 1982 approximately 100 family units (50% of the total population) each harvested 250 kg of Arctic charr annually for an estimated total harvest of 25 000 kg. This figure represents a 70% reduction in harvest from the 1964 estimates and is considered reflective of the changing

fisheries utilization within the community. Additional comments from this source indicated that the overall fish size has increased during the last five year period and that harvest levels have been static over the past three year period.

Today, the subsistence fishery is comprised of two components, a summer open water fishery, and a fall-winter fishery through the ice. Fishing begins as soon as breakup is complete, usually June 15 to 20th, and continues for 2 to 3 weeks (Roger Binne, personal communication). Activity is low until mid-August when the charr begin to return to the river from the ocean. Fishing is concentrated at this time near the river mouth for a 3 to 4 week period. Fishing effort is again light until freeze-up is complete at which time the period of greatest activity commences, usually October through to early December. Gillnets used in both fisheries vary from 10 to 50 m in length, from 1.5 to 2.5 m in depth, and from 89 to 139 mm in mesh size. Approximately 20 percent of the fishermen are active during the summer period with the majority of charr caught being dried or frozen whole for human consumption. Culled or soft fish and other species are utilized for dog food. During the fall and winter fishery effort is intensified with fishermen using 2 or 3 nets each and utilizing the entire river from Bloody Falls to the mouth. At present the commercial quota of 600 kg is taken during the two periods of domestic fishing.

FISHERY SURVEY

During the period August 13 to August 20, 1981 the domestic fishery was surveyed. Contact was established with the Coppermine Hunters and Trappers Association and the GNWT Wildlife Service, to facilitate coordinating the study with resident fishermen. Domestic fishermen were interviewed immediately after they had checked their nets, catches were identified and recorded, biological samples obtained, and a record kept of net sizes, locations and numbers of hours fished. Nets were usually checked twice a day and often assistance was given to the fishermen to pull their nets in order to obtain samples and effort data. An experimental netting program was also conducted during the survey period using a 125 m gillnet composed of five 25 m panels, 38 mm, 64 mm, 89 mm, 114 mm, and 139 mm in mesh size (stretched measure). Four sets of 12 to 24 hour duration were completed to determine the size range of charr in the system and to provide additional catch and effort data.

Additional domestic gillnetting was conducted during the fall fishery by GNWT Wildlife Officers in 1981 and again in 1982. During 1981 two locations were chosen and two nets were used, one of 89 mm mesh size and one of 139 mm mesh size. Three twenty-four hour sets with each net were made between October 28 and November 23. The survey was repeated during the fall of 1982 using 6 nets, two of 89 mm mesh size, and four of 139 mm mesh size. Fishing took place at various times between September 8 and November 3. A summary of the data collected appears in Table 1. All Arctic charr captured were sampled for biological information.

BIOLOGICAL INVESTIGATION

Arctic charr were sampled for fork length (±1mm), round weight (±25g), sex and maturity. Maturity was determined by gross examination of the gonads (see Appendix). Saggital otoliths were taken from sampled Arctic charr for age determination. Otoliths were stored dry in coin envelopes marked with the sample information. Age determination was conducted in the laboratory by grinding the convex surface of the otoliths on a fine carborundum stone to expose the annual growth zones. Otoliths were then cleared in a 3:1 solution of benzyl-benzoate and methyl salicylate, placed in a depression slide, and the annual growth zones read under a dissecting microscope (x30).

Other species of fish captured during the survey were counted and identified according to Scott and Crossman (1973) and Hart (1973). As numbers captured were low no samples were taken of the incidental species.

The length-weight relationship for Arctic charr from all years combined was determined using the following equation:

$$\log_{10}W = a + b\ (\log_{10}L)$$

where W = weight in grams
L = fork length in millimeters

Condition factor was calculated as:

$$K = \frac{W \times 10^5}{L^3}$$

where W = weight in grams
L = fork length in millimeters

Growth rate was fitted by eye and compared with growth rates of charr from other locations in the N.W.T.

Catch per unit of effort (CPE) was calculated by dividing the number of charr caught by the length of net set (in meters) and the number of hours fished.

DATA ANALYSIS

Data collected during the study were analyzed using an Amdahl 470/V7 computer based at the University of Manitoba with a terminal located at the Freshwater Institute. The Statistical Analysis System (1979) was used to generate length, weight, sex and maturity summaries and to perform basic calculations. Some additional calculations were performed using a Hewlett-Packard programmable calculator (Model 9810-A).

RESULTS

FISHERY SURVEY

During the period August 12 to August 20, 1981 a total of 28 domestic fishermen using 42 gillnets were observed fishing the Coppermine River. Effort declined during the observation period until only 10 fishermen with 11 nets were left. A total of 22 domestic interviews were conducted recording 560 hours of fishing effort. Information on mesh sizes, lengths of gillnet, hours fished, and CPE for the summer domestic fishery interviews is presented in Table 1. Of the total catch of 166 fish, 127 were Arctic charr and 39 were assorted species (Table 2).

Experimental gillnets set at 4 locations near Coppermine (Fig. 2) during the period August 15 to August 19 yielded a total catch of 206 fish of which 42 were Arctic charr (Table 2). Catch per unit of effort, mesh size, and hours fished by experimental gillnets is given in Table 1.

The 1981 fall-winter domestic gillnets set by the Wildlife Officer from Coppermine (Fig. 2) caught a total of 80 Arctic charr (Table 1). Catch numbers for incidental species were not recorded for the above domestic nets. Information on the 1982 fall survey which was conducted by the same method is presented in Table 1.

BIOLOGICAL INVESTIGATION

Biological data by length interval for Arctic charr captured by domestic gillnets in August 1981 are presented in Table 3. Mean fork length, sexes combined, was 654 mm (N=127) and mean round weight was 3 868 g. The length-frequency distribution for males, females and the combined sample is shown in Fig. 3. Modal fork length was 750-799 mm. Biological data by age group for this fishery are shown in Table 4. Mean age, sexes combined, was 9.5 yr (N=116). The age-frequency distribution is shown in Fig. 4. Modal age was 8 yr.

Biological data by length interval for Arctic charr captured by the domestic gillnets during October and November, 1981 are presented in Table 5. Mean fork length was 509 mm (N=80) and mean round weight was 2 004 g. The length-frequency distribution for males, females and the combined sample is shown in Fig. 3. Modal fork length was 400-449 mm. Biological data by age group are presented in Table 6. Mean age, sexes combined, was 7.1 yr (N=69). The age-frequency distribution is shown in Fig. 4. Modal age was 5 yr. Biological data by length interval for Arctic charr taken by domestic gillnet fishing during September to November, 1982 are presented in Table 7. Mean fork length was 583 mm (N=96) and mean round weight was 2 661 g. The length-frequency distribution for males, females and the combined sample is shown in Fig. 3. Modal fork length was 500-549 mm. Biological data by age group are presented in Table 8. Mean age, sexes combined, was 8.5 yr (N=82). The age-frequency distribution is shown in Fig. 4. Modal age was 6 yr. Biological data by length interval for Arctic charr captured by experimental gillnets during August, 1981 are presented in Table 9. Mean fork length was 418 mm (N=42) and mean round weight was 1 036 g. The length-frequency distribution for males, females and the combined sample is shown in Fig. 3. Modal fork length was 300-349 mm. Biological data by age group are presented in Table 10. Mean age, sexes combined, was 5.6 yr (N=41). The age frequency distribution is shown in Fig. 4. Modal age was 5 yr.

Biological data by length interval for the 1981 sample from all gillnets combined (N=249) are presented in Table 11. Biological data by age group for the 1981 sample from all gillnets are presented in Table 12.

The calculated length-weight relationship for Arctic charr captured by gillnets (N=249) from the Coppermine river during 1981 is as follows:

$$\log_{10}W = -5.34 + 3.15\ (\log_{10}L)$$

The growth rate of Arctic charr from the Coppermine River is similar to that of Arctic charr from the Tree River and the Hornaday River (Fig. 5). In comparison to the Jayco River system, charr from the Coppermine are relatively fast growing.

ACKNOWLEDGMENTS

Our appreciation is extended to Roger Binne and Colin Adjun, Wildlife Officers, Government of the Northwest Territories, Coppermine, for their assistance in coordinating and conducting the sampling of the fishery. Mr. R. Pedersen of Coppermine, Northwest Territories is thanked for his helpful remarks on previous fishing activity and dog populations in the Coppermine area. The officers of the Royal Canadian Mounted Police at Coppermine are thanked for their provision of storage space and assistance with vehicles and vessels. Mr. G. Carder determined the ages of the charr sampled and figures were prepared by Graphic Services, Freshwater Institute. Typing was done by M. Leyden and S. Ahlgren. An earlier draft of this report was reviewed by J. T. Strong. K.T.J. Chang-Kue reviewed the final draft.

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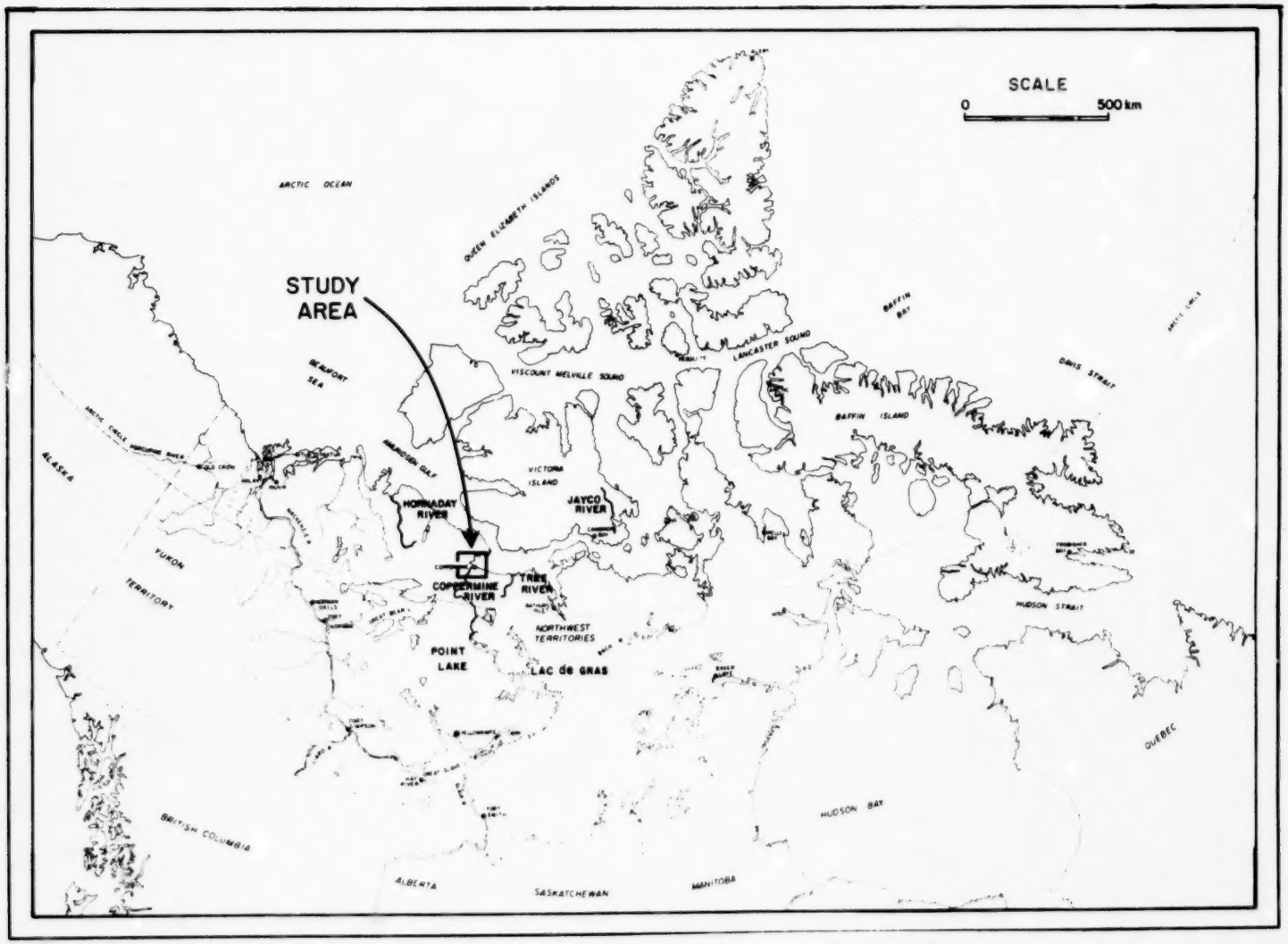


Fig. 1. Map of the Northwest Territories showing the location of the Coppermine River.

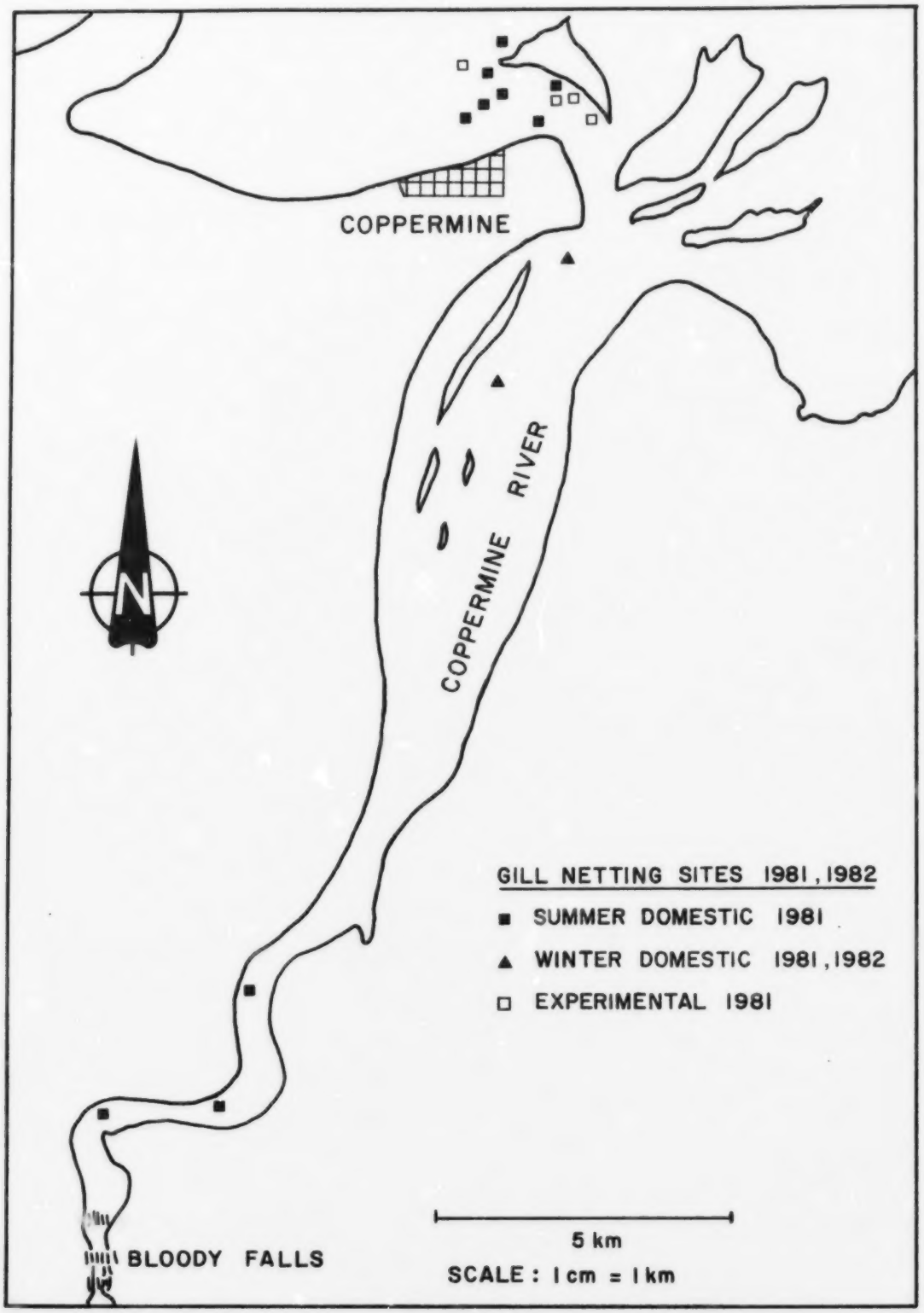


Fig. 2. Map of the Coppermine River illustrating the area studied, locations fished and experimental gillnetting sites during summer and winter 1981 and 1982.

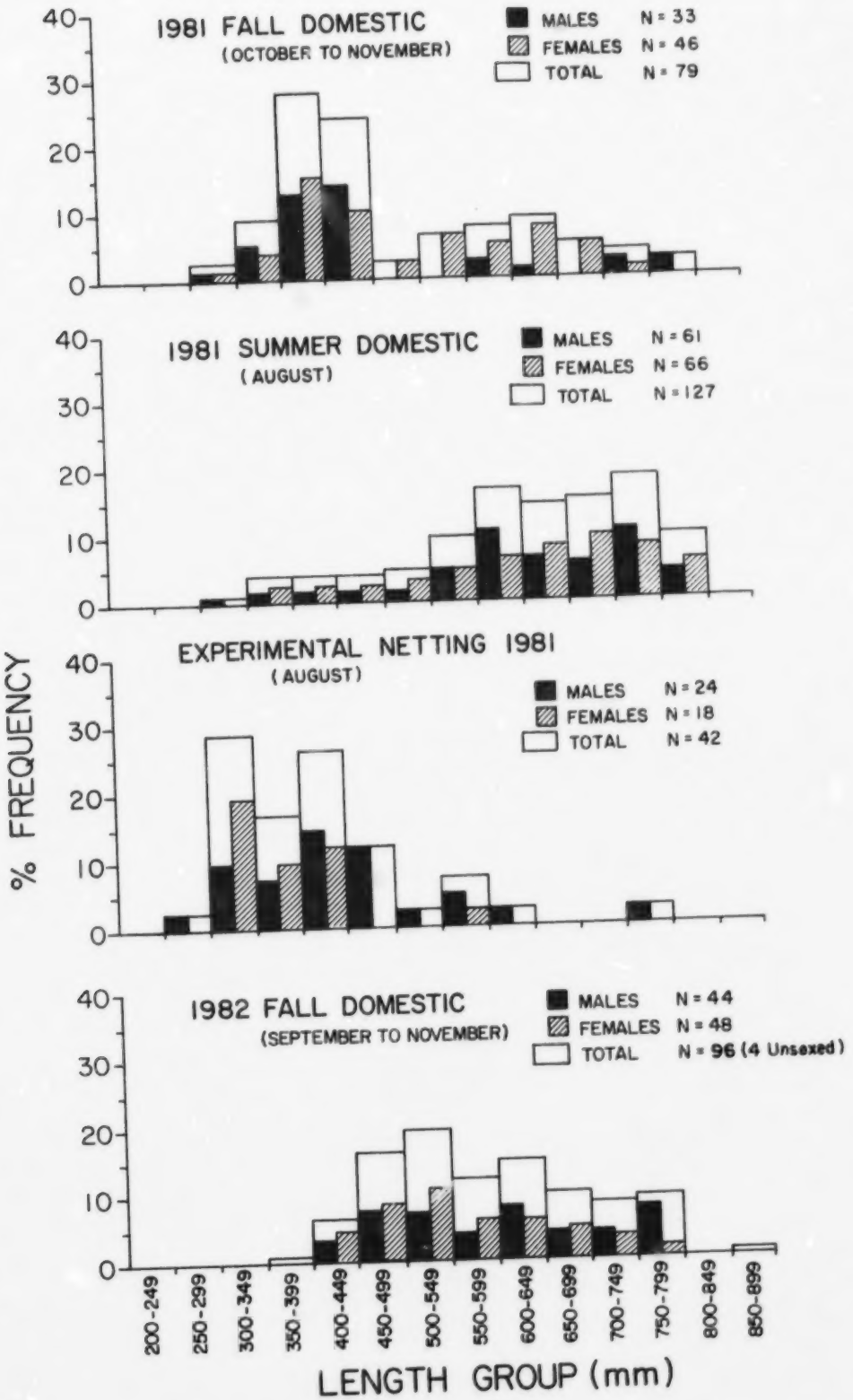


Fig. 3. Length-frequency distributions of Arctic charr captured by domestic and experimental gillnets in the Coppermine River, 1981 and 1982.

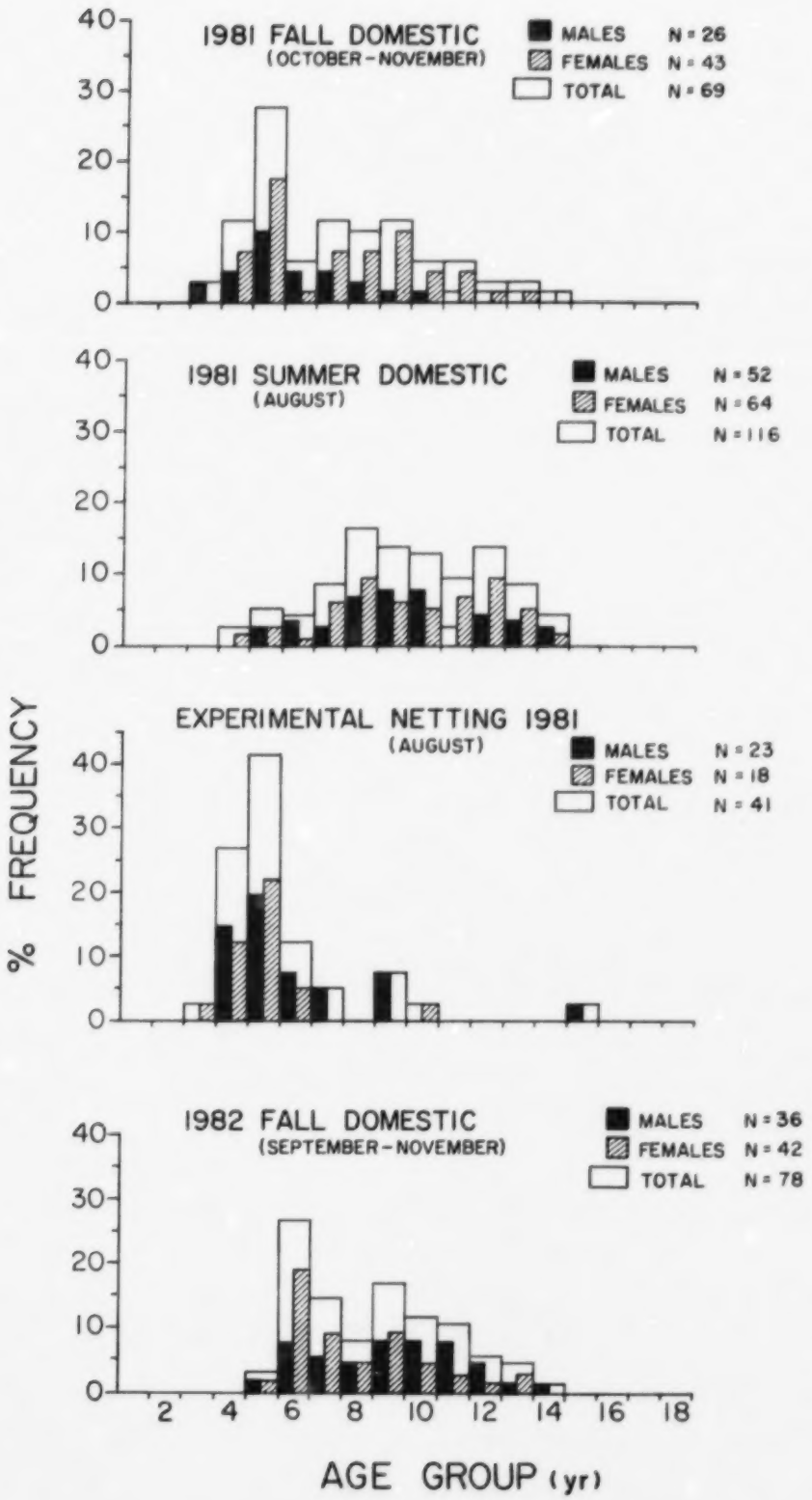


Fig. 4. Age-frequency distributions of Arctic charr captured by domestic and experimental gillnets in the Coppermine River, 1981 and 1982.

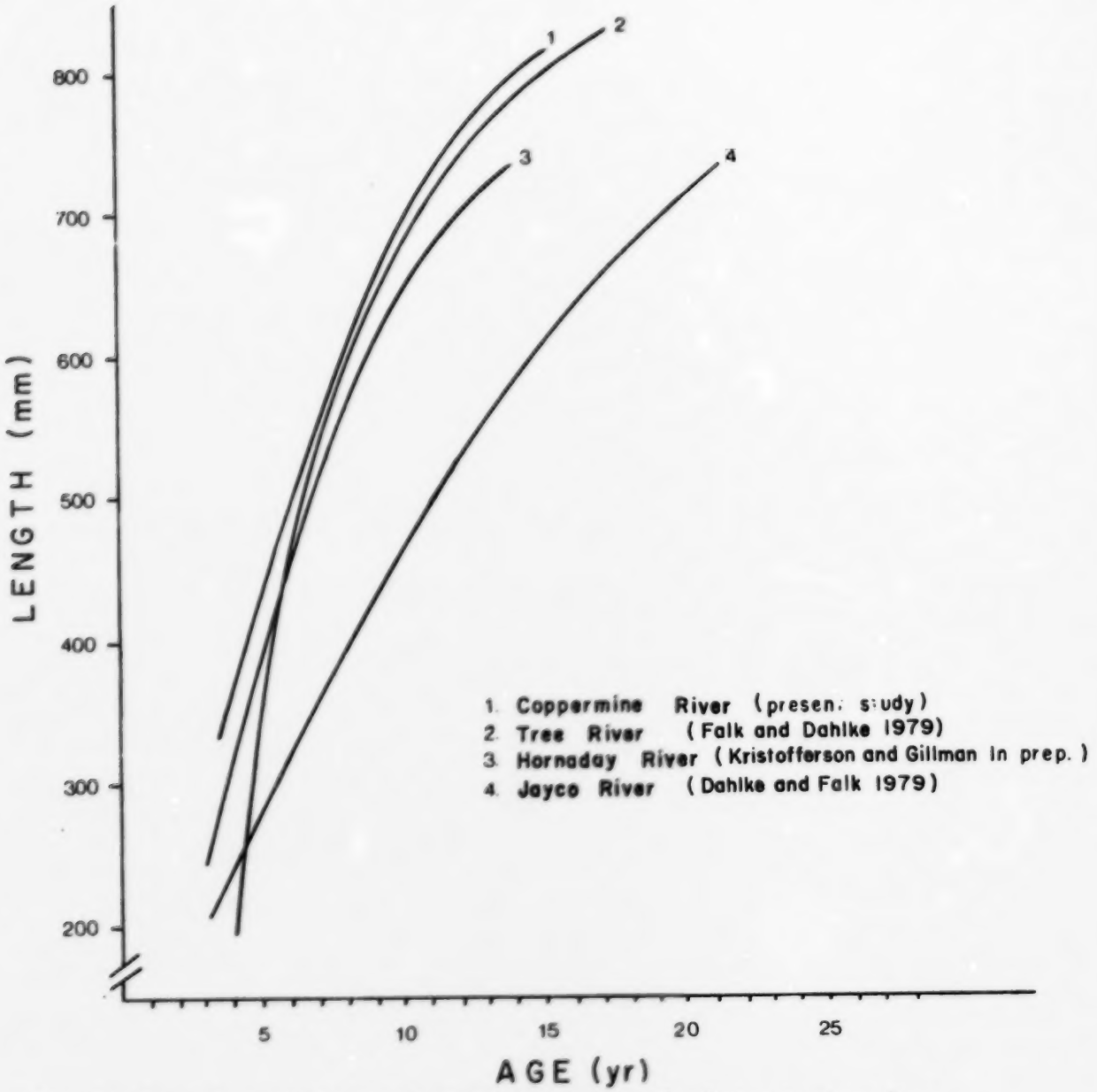


Fig. 5. Comparison of the growth rate (fitted by eye) of Arctic charr from the Coppermine River, 1981, with those of charr from other locations in the Northwest Territories.

Table 1. A summary of catch and effort data by mesh size for Arctic charr taken by domestic and experimental gillnets in the Coppermine River, 1981 and 1982.

Fishery	Mesh Size (mm)	No. Inter-views	Total Length Fished (m)	Total Hours Fished	Total No. Caught	No./ 100 m/ 24 h	Mean Fork Length (mm)
Summer Domestic Fishery 1981	89	2	40	34	6	10.6	465
	114	4	95	120	28	5.9	536
	139	16	675	406	93	0.8	668
Experimental Fishery 1981	38	1	25	80	1	1.2	450
	64	1	25	80	26	31.2	374
	89	1	25	80	6	7.2	413
	114	1	25	80	3	3.6	442
	139	1	25	80	6	7.2	598
Fall Domestic Fishery 1981	89	1	25	72	52	69.3	432
	139	1	25	72	28	37.3	653
Fall Domestic Fishery 1982	89	2	75	no data	46		531
	139	4	200	no data	52		623

Table 2. The number and species of fish captured by domestic and experimental gillnets in the Coppermine River, 1981.

Species	Scientific Name	Numbers caught		
		Summer Domestic	Fall Domestic	Experimental
Arctic charr	*Salvelinus alpinus* (Linnaeus)	127	80	42
Lake whitefish	*Coregonus clupeaformis* (Mitchill)	7	70	82
Broad whitefish	*Coregonus nasus* (Pallas)	13	6	23
Arctic cisco	*Coregonus autumnalis* (Pallas)	-	N/A	8
Least cisco	*Coregonus sardinella* Valenciennes	-	N/A	3
Longnose sucker	*Catostomus catostomus* (Forster)	-	N/A	31
Pacific herring	*Clupea harengus pallasi* Valenciennes	1	N/A	1
Starry flounder	*Platichthys stellatus* (Pallas)	18	N/A	13
Saffron cod	*Eleginus gracilis* (Tilesius)	-	-	3

Table 3. Biological data by length interval for Arctic charr captured by domestic gillnets in the Coppermine River during August, 1981.

LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
		LENGTH(MM)	WEIGHT(G)			%		LENGTH(MM)	WEIGHT(G)			%		LENGTH(MM)	WEIGHT(G)			%
	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT
300	1	348	500	-	1.19	0	-	-	-	-	-	-	1	348	500	-	1.19	0
350	2	373	638	265	1.19	0	3	355	517	58	1.16	0	5	362	565	154	1.17	0
400	2	438	1025	35	1.22	0	3	428	933	153	1.19	0	5	432	970	120	1.20	0
450	2	465	1125	247	1.11	0	3	465	1200	218	1.18	0	5	465	1170	202	1.16	0
500	2	520	1675	247	1.19	50	4	532	1988	118	1.32	25	6	528	1883	216	1.28	33
550	6	575	2408	252	1.26	17	6	565	2375	223	1.32	83	12	570	2392	227	1.29	50
600	13	622	3092	729	1.28	69	8	626	3306	706	1.34	88	21	623	3174	711	1.30	76
650	8	670	3750	405	1.25	88	10	673	3930	467	1.29	100	18	672	3850	438	1.27	94
700	7	723	4821	269	1.28	100	12	724	5050	686	1.33	100	19	724	4966	569	1.31	100
750	13	776	5481	671	1.17	100	10	761	5680	765	1.29	100	23	770	5567	704	1.22	100
800	5	828	6500	933	1.15	100	7	814	6629	748	1.23	100	12	819	6575	792	1.19	100
TOTAL	61						66						127					
MEAN		658	3796	1759	1.22			651	3935	1895	1.29			654	3868	1825	1.26	

Table 4. Biological data by age group for Arctic charr captured by domestic gillnets in the Coppermine River during August, 1981.

AGE (YR)	MALES							FEMALES							COMBINED						
		LENGTH(MM)		WEIGHT(G)			%		LENGTH(MM)		WEIGHT(G)			%		LENGTH(MM)		WEIGHT(G)			%
	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT
4	1	350	-	450	-	1.05	0	2	350	0.0	500	71	1.17	0	3	350	0.0	483	58	1.13	0
5	3	460	39.1	1183	275	1.20	0	3	432	28.6	917	126	1.14	0	6	446	34.2	1050	241	1.17	0
6	4	418	57.4	894	331	1.19	0	1	442	-	1100	-	1.27	0	5	423	50.9	935	301	1.21	0
7	3	592	53.0	2583	643	1.23	67	7	520	91.0	1857	890	1.22	29	10	541	85.7	2075	862	1.22	40
8	8	606	40.4	2756	566	1.23	25	11	610	59.2	3132	900	1.35	82	19	608	50.9	2974	781	1.30	58
9	9	658	60.9	3589	1171	1.22	100	7	629	73.5	3379	1279	1.31	86	16	645	66.0	3497	1182	1.26	94
10	9	697	56.4	4728	1146	1.39	100	6	668	65.2	4050	1155	1.34	100	15	685	59.7	4457	1160	1.37	100
11	3	745	17.6	4950	150	1.20	100	8	706	30.9	4463	876	1.26	100	11	717	32.6	4595	771	1.24	100
12	5	771	16.8	5090	319	1.11	100	11	767	49.0	5773	982	1.28	100	16	768	41.0	5559	882	1.22	100
13	4	783	33.8	5538	350	1.17	100	6	763	29.9	6142	758	1.38	100	10	771	31.4	5900	676	1.30	100
14	3	801	39.2	6250	650	1.22	100	2	800	0.0	6275	530	1.23	100	5	801	27.7	6260	531	1.22	100
TOTAL	52							64							116						
MEAN		651	125	3720	1747	1.23			648	124.6	3888	1892	1.29			649	124.1	3813	1822	1.26	
MEAN AGE	9.5																				

Table 5. Biological data by length interval for Arctic charr captured by domestic gillnets in the Coppermine River during October and November, 1981.

LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT
300	1	345	400	-	0.97	0	1	310	325	-	1.09	0	2	328	363	53	1.03	0
350	4	361	450	58	0.95	0	3	377	517	58	0.96	0	8	371	488	64	0.95	0
400	10	421	809	95	1.08	0	12	424	837	134	1.09	0	22	423	824	116	1.09	0
450	11	461	1044	104	1.06	18	8	462	1030	114	1.04	0	19	462	1038	105	1.05	11
500	-	-	-	-	-	-	2	538	2000	707	1.28	100	2	538	2000	707	1.28	100
550	-	-	-	-	-	-	5	569	2320	333	1.25	100	5	569	2320	333	1.25	100
600	2	615	3100	636	1.33	100	4	609	2713	307	1.20	100	6	611	2842	421	1.24	100
650	1	680	4350	-	1.38	100	6	658	3792	505	1.32	100	7	661	3871	507	1.33	100
700	-	-	-	-	-	-	4	721	5563	696	1.48	100	4	721	5563	696	1.48	100
750	2	784	6900	141	1.43	100	1	750	6250	-	1.48	100	3	773	6683	388	1.45	100
800	2	810	7880	156	1.48	100	-	-	-	-	-	-	2	810	7880	156	1.48	100
TOTAL	33						46						80					
MEAN		490	1875	2248	1.13			525	2127	1682	1.18			509	2004	1924	1.16	

Table 6. Biological data by age group for Arctic charr captured by domestic gillnets in the Coppermine River during October and November, 1981.

AGE (YR)	MALES							FEMALES							COMBINED					
	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT
3	2	375	42.4	575	247	1.05	0	-	-	-	-	-	-	-	2	375	42.4	575	247	1.05	0
4	3	406	59.2	623	236	0.91	0	5	413	60.4	748	271	1.02	0	8	411	55.7	701	249	0.98	0
5	7	438	29.4	904	204	1.06	0	12	432	27.9	854	184	1.05	0	19	434	27.8	873	188	1.05	0
6	3	443	19.7	983	225	1.12	33	1	410	-	770	-	1.12	0	4	435	22.9	930	213	1.12	25
7	3	453	20.8	1017	153	1.09	33	5	464	67.3	1230	556	1.18	20	8	460	52.4	1150	442	1.15	25
8	2	548	109.6	2325	1732	1.26	50	5	618	35.8	3130	621	1.32	100	7	598	63.6	2900	955	1.30	86
9	1	450	-	1050	-	1.15	0	7	601	59.5	2800	1000	1.26	100	8	582	76.7	2581	1113	1.25	88
10	1	605	-	2650	-	1.20	100	3	610	69.3	2683	1032	1.13	100	4	609	56.6	2675	843	1.15	100
11	1	780	-	7000	-	1.48	100	3	682	20.2	4650	522	1.46	100	4	706	51.9	5238	1250	1.47	100
12	1	680	-	4350	-	1.38	100	1	730	-	5500	-	1.41	100	2	705	35.4	4925	813	1.40	100
13	1	810	-	7990	-	1.50	100	1	750	-	6250	-	1.48	100	2	780	42.4	7120	1230	1.49	100
14	1	810	-	7770	-	1.46	100	-	-	-	-	-	-	-	1	810	-	7770	-	1.46	100
TOTAL	26							43							69						
MEAN		498	134	1954	2271	1.14			526	114.2	2091	1570	1.18			516	121.9	2039	1850	1.16	
MEAN AGE	7.1																				

Table 7 . Biological data by length interval for Arctic charr captured by domestic gillnets in the Coppermine River, September to November, 1982.

Length Interval (mm)	Males						Females						Combined					
	Length (mm)		Weight (g)			%	Length (mm)		Weight (g)			%	Length (mm)		Weight (g)			%
	N	Mean	Mean	SD	K	Mat	N	Mean	Mean	SD	K	Mat	N	Mean	Mean	SD	K	Mat
350	-	-	-	-	-	-	-	-	-	-	-	-	1	390	600	-	1.01	0
400	3	417	767	153	1.05	0	5	430	870	97	1.09	40	7	424	821	129	1.07	29
450	7	473	1129	204	1.06	71	9	468	1078	135	1.05	89	16	470	1100	164	1.06	81
500	6	524	1517	147	1.05	67	11	513	2514	1666	1.85	91	18	518	2181	1369	1.57	78
550	4	565	2413	853	1.34	100	7	564	2614	1063	1.43	86	12	565	2513	913	1.38	83
600	8	623	2869	494	1.18	88	6	613	2758	372	1.19	100	14	619	2821	434	1.19	93
650	4	665	3338	236	1.13	100	5	671	3680	172	1.22	100	10	668	3555	261	1.19	90
700	4	729	4288	712	1.11	100	3	717	4233	611	1.15	100	8	722	4294	576	1.19	88
750	7	778	4929	95	1.05	100	2	760	5100	707	1.16	100	9	774	4967	274	1.07	100
850	1	880	8000	-	1.17	100	-	-	-	-	-	-	1	880	8000	-	1.17	100
Total	44						48						96					
Mean		610	2839	1651	1.12			555	2455	1445	1.34			583	2661	1538	1.24	

Table 8. Biological data by age group for Arctic charr captured by domestic gillnets in the Coppermine River, September to November, 1982.

Age (yr)	Males							Females							Combined						
	Length (mm)			Weight (g)			%	Length (mm)			Weight (g)			%	Length (mm)			Weight (g)			%
	N	Mean	SD	Mean	SD	K	Mat	N	Mean	SD	Mean	SD	K	Mat	N	Mean	SD	Mean	SD	K	Mat
5	1	400	-	600	-	0.94	0	1	430	-	900	-	1.13	100	2	415	21.2	750	212	1.04	50
6	6	494	38.0	1292	291	1.06	83	15	492	47.7	2020	1652	1.53	80	21	490	47.8	1798	1441	1.39	81
7	4	529	41.3	1550	370	1.03	75	7	501	41.3	1436	360	1.12	86	11	511	41.6	1477	350	1.09	82
8	3	590	55.7	2383	801	1.13	67	3	507	55.1	2717	2059	2.03	67	7	547	61.6	2543	1287	1.58	57
9	6	646	67.7	3308	1020	1.21	100	7	618	53.7	2943	779	1.23	100	13	631	59.7	3112	879	1.22	100
10	6	622	117.8	3150	1625	1.19	100	3	577	86.2	2500	950	1.27	100	11	608	96.2	2945	1309	1.23	82
11	6	684	90.5	3808	1003	1.23	100	2	665	77.8	3725	1662	1.22	100	9	683	77.7	3867	1016	1.23	89
12	3	780	0.0	4917	153	1.04	100	1	600	-	2450	-	1.13	100	4	735	90.0	4300	1240	1.06	100
13	1	880	-	8000	-	1.17	100	2	678	3.5	3775	35	1.21	100	3	745	116.9	5183	2439	1.20	100
15	-	-	-	-	-	-	-	1	730	-	3700	-	0.95	100	1	730	-	3700	-	0.95	100
Total	36							42							82						
Mean		616	120	2946	1682	1.13			545	85.8	2349	1378	1.37			580	107.8	2651	1531	1.26	
Mean Age	8.5																				

Table 9. Biological data by length interval for Arctic charr captured by experimental gillnets in the Coppermine River during August, 1981.

LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
	LENGTH(MM)		WEIGHT(G)			%	LENGTH(MM)		WEIGHT(G)			%	LENGTH(MM)		WEIGHT(G)			%
	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT
250	1	298	325	-	1.23	0	-	-	-	-	-	-	1	298	325	-	1.23	0
300	4	329	431	55	1.21	0	8	338	491	50	1.27	0	12	335	471	57	1.25	0
350	3	381	708	146	1.27	33	4	364	625	29	1.30	0	7	371	661	98	1.29	14
400	6	423	1042	334	1.36	0	5	424	860	152	1.12	0	11	423	959	272	1.25	0
450	5	459	1220	205	1.25	0	-	-	-	-	-	-	5	459	1220	205	1.25	0
500	1	545	1850	-	1.14	100	-	-	-	-	-	-	1	545	1850	-	1.14	100
550	2	592	2900	71	1.40	0	1	553	1800	-	1.06	0	3	579	2533	637	1.29	0
600	1	622	2600	-	1.08	100	-	-	-	-	-	-	1	622	2600	-	1.08	100
750	1	795	4200	-	0.84	100	-	-	-	-	-	-	1	795	4200	-	0.84	100
TOTAL	24						18						42					
MEAN		447	1291	973	1.26			379	696	327	1.23			418	1036	815	1.24	

Table 10. Biological data by age group for Arctic charr captured by experimental gillnets in the Coppermine River during August, 1981.

AGE (YR)	MALES							FEMALES							COMBINED						
	LENGTH(MM)			WEIGHT(G)			%	LENGTH(MM)			WEIGHT(G)			%	LENGTH(MM)			WEIGHT(G)			%
	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT
3	-	-	-	-	-	-	-	1	340	-	575	-	1.46	0	1	340	-	575	-	1.46	0
4	6	330	26.3	442	98	1.22	17	5	342	13.5	490	89	1.22	0	11	335	21.4	464	93	1.22	9
5	8	423	19.2	1022	288	1.33	0	9	377	41.5	678	186	1.25	0	17	399	39.8	840	291	1.29	0
6	3	430	45.0	967	284	1.19	0	2	416	19.8	800	212	1.10	0	5	424	34.2	900	245	1.15	0
7	2	467	0.0	1400	212	1.37	0	-	-	-	-	-	-	-	2	467	0.0	1400	212	1.37	0
9	3	602	18.8	2800	180	1.30	33	-	-	-	-	-	-	-	3	602	18.8	2800	180	1.30	33
10	-	-	-	-	-	-	-	1	553	-	1800	-	1.06	0	1	553	-	1800	-	1.06	0
15	1	795	-	4200	-	0.84	100	-	-	-	-	-	-	-	1	795	-	4200	-	0.84	100
TOTAL	23							18							41						
MEAN		443	115	1266	987	1.26			379	57.6	696	327	1.23			415	98.7	1016	815	1.25	
MEAN AGE	5.6																				

Table 11. Biological data by length interval for Arctic charr captured by all gillnets combined, Coppermine River, 1981.

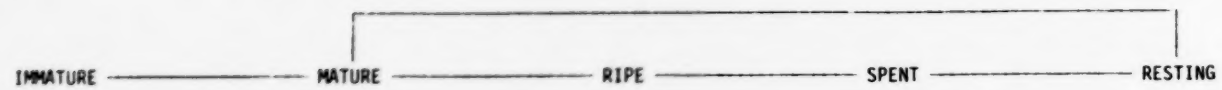
LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT
250	1	298	325	-	1.23	0	-	-	-	-	-	-	1	298	325	-	1.23	0
300	6	335	438	54	1.17	0	9	335	472	72	1.25	0	15	335	458	66	1.22	0
350	9	370	578	176	1.11	11	10	365	560	70	1.16	0	20	369	568	124	1.13	5
400	18	424	911	227	1.19	0	20	425	857	137	1.11	0	38	424	883	184	1.15	0
450	18	461	1102	162	1.12	11	11	463	1076	158	1.08	0	29	462	1092	158	1.11	7
500	3	528	1733	202	1.17	67	6	534	1992	329	1.31	50	9	532	1906	308	1.26	56
550	8	579	2531	313	1.30	13	12	566	2304	298	1.27	83	20	571	2395	317	1.28	55
600	16	621	3063	684	1.27	75	12	620	3108	655	1.29	92	28	621	3082	659	1.28	82
650	9	671	3817	429	1.26	89	16	668	3878	470	1.30	100	25	669	3856	447	1.29	96
700	7	723	4821	269	1.28	100	16	723	5178	703	1.37	100	23	723	5070	620	1.34	100
750	16	778	5578	854	1.18	100	11	760	5732	746	1.31	100	27	771	5641	800	1.23	100
800	7	823	6894	1019	1.24	100	7	814	6629	748	1.23	100	14	818	6761	870	1.24	100
TOTAL	118						130						249					
MEAN		568	2749	2092	1.20			569	2847	2060	1.24			568	2791	2073	1.22	

Table 12. Biological data by age group for Arctic charr captured by all gillnets combined, Coppermine River, 1981.

AGE (YR)	MALES							FEMALES							COMBINED						
	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT
3	2	375	42.4	575	247	1.05	0	1	340	-	575	-	1.46	0	3	363	36.2	575	175	1.19	0
4	10	355	49.6	497	159	1.11	10	12	373	51.8	599	218	1.13	0	22	365	50.4	553	196	1.12	5
5	18	435	28.6	1003	260	1.21	0	24	411	42.1	796	197	1.13	0	42	421	38.4	885	246	1.16	0
6	10	429	41.8	943	260	1.17	10	4	421	18.3	868	198	1.15	0	14	427	36.1	921	239	1.16	7
7	8	509	75.4	1700	832	1.21	38	12	497	83.6	1596	806	1.20	25	20	501	78.6	1638	796	1.21	30
8	10	594	56.7	2670	785	1.23	30	16	612	51.9	3131	801	1.34	88	26	605	53.4	2954	812	1.30	65
9	13	629	77.5	3212	1208	1.24	77	14	615	65.9	3089	1143	1.29	93	27	622	70.6	3148	1153	1.26	85
10	10	688	60.6	4520	1265	1.37	100	10	639	71.3	3415	1310	1.25	90	20	664	69.2	3968	1375	1.31	95
11	4	754	22.5	5463	1032	1.27	100	11	700	29.7	4514	774	1.31	100	15	714	36.9	4767	919	1.30	100
12	6	756	40.1	4967	416	1.16	100	12	764	47.9	5750	940	1.29	100	18	761	44.4	5489	876	1.24	100
13	5	788	31.7	6028	1138	1.23	100	7	761	27.7	6157	693	1.40	100	12	772	31.4	6103	859	1.33	100
14	4	803	32.3	6630	927	1.28	100	2	800	0.0	6275	530	1.23	100	6	802	25.1	6512	778	1.26	100
15	1	795	-	4200	-	0.84	100	-	-	-	-	-	-	-	1	795	-	4200	-	0.84	100
TOTAL	101							125							226						
MEAN		564	154	2707	2054	1.21			567	147.7	2810	2024	1.24			566	150.3	2764	2033	1.23	
MEAN AGE	8.0																				

Appendix 1. A flow chart and code for the determination of the maturity stages of Arctic charr.

MATURITY FLOW CHART



FISH MATURITY CODE

Maturity Stage		Female		Male
Immature (virgin)	1	-Ovaries granular in texture -hard and triangular in shape -up to full length of body cavity -membrane firm -eggs distinguishable	6	-Testes long and thin -tubular and scalloped shape -up to full body length -putty like firmness
Mature	2	-Current year spawner -ovary fills body cavity -eggs near full size but not loose -not expelled by pressure	7	-Current year spawner -testes large and lobate -white to purplish color -centers may be fluid -milt not expelled by pressure
Ripe	3	-Ovaries greatly extended & fill body cavity -eggs full size and transparent -expelled by slight pressure	8	-Testes full size -white and lobate -milt expelled by slight pressure
Spent	4	-Spawning complete -ovaries ruptured and flaccid -seed eggs visible -some retained eggs in body cavity	9	-Spawning complete -testes flaccid with some milt -blood vessels obvious -testes violet-pink in color
Resting	5	-Ovary 40-50% of body cavity -membrane thin, loose, & semi-transparent -healed from spawning -seed eggs apparent with few atretic eggs -some eggs may be retained in body cavity	10	-Testes tubular, less lobate -healed from spawning -no fluid in center -usually full length -mottled and purplish in color
Unknown (virgin)	0	-cannot be sexed -gonads long or short & thin -transparent or translucent		
Unknown (non-virgin)	11	-resting fish -has spawned but gonads regenerated -sexing not possible		

POOR

QUALITY

ORIGINAL